



**State of New Jersey**  
**DEPARTMENT OF ENVIRONMENTAL PROTECTION**  
DIVISION OF HAZARDOUS WASTE MANAGEMENT  
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July 3, 1991

Angela Dohl  
Environmental Engineer  
American Cyanamid Company  
Warners Plant  
P.O. Box 31  
Linden, New Jersey 07036

Dear Ms. Dohl:

Enclosed are the copies of the Preliminary Assessments conducted by the Bureau of Planning and Assessment for the Cyanamid landfills in Cartaret and Linden. As discussed the Bureau is planning to sample both landfills as soon as approval is received from the USEPA; you will be contacted at that time.

If you have any questions concerning the Preliminary Assessments, please contact Hayder Camargo or myself at (609) 584-4280.

Sincerely,

Donna J. van Veldhuisen  
HSMS II

DV:mz  
Enclosure



AMERICAN CYANAMID LANDFILL  
WOOD AVENUE  
LINDEN CITY, UNION COUNTY, NEW JERSEY  
EPA ID NO. NJD981178049

GENERAL INFORMATION AND SITE HISTORY

American Cyanamid Landfill is located on Block 457, Lots 17A and 20A in Linden City, Union County. The landfill is approximately 10 acres in size and is currently inactive. The site is bound to the north and east by Piles Creek, a tributary of the Rahway River. West of the site is an oil and gasoline storage tank farm owned by Exxon Oil Company and to the south is a warehouse facility owned by American Cyanamid. Land use in the vicinity of the site is developed for light industrial purposes. The estimated population within 1 mile of the site is greater than 20,000. The population within a 4-mile radius of the site is greater than 300,000.

American Cyanamid purchased the property in the early 1940s and started disposing of bulky dry hazardous wastes, dry nonhazardous chemicals, industrial wastes and liquid chemical wastes in the landfill in 1948. The landfill was closed in 1980 in accordance with a NJDEP approved closure plan. The closure consisted of installing a clay cap which was covered with top soil and seeded. In addition, a clay wall was installed around the landfill, however the landfill is unlined.

At present the American Cyanamid Landfill is no longer monitored by the NJDEP, Division of Water Resources (DWR) as it falls under the Vi-Concrete determination of 1989. The Vi-Concrete decision invalidated all NJPDES permits and monitoring requirements for sanitary landfills in New Jersey which closed prior to January 1, 1982.

SITE OPERATIONS OF CONCERN

The American Cyanamid Landfill received its waste from the American Cyanamid Warners Plant in Linden. The Warners Plant was the second oldest manufacturing plant in the American Cyanamid Company and was also the location of Cyanamid's first research laboratory where many of the company's products were developed. The plant produced a variety of organic and inorganic chemicals which included sulfuric acid, acrylamide, polyacrylamide, water and wastewater treatment chemicals, paper and fabric treatment chemicals, mining and ore production chemicals, malathion and surfactants. The Warner plant closed in 1989 and the exact amount of chemical waste buried at the Linden landfill is unknown.

A review of historical records of the Linden landfill has identified several spills or releases of hazardous substances. During a site visit by the NJDEP, Division of Solid Waste Management on October 23, 1975, 55-gallon drums were noted to be imbedded within the perimeter of the landfill at several locations. A very strong pungent odor was associated with the drums and stained sand was observed. A small spill or seepage was also observed in the meadow, killing meadow vegetation and imparting an ink-like, bluish hue to the marsh.

On June 19, 1987 during a NJDEP, Division of Hazardous Waste Management (DHWM) site inspection, conduits which extended from the landfill to a drainage ditch and the creek were observed. At the base of one such conduit on the western side of the landfill, a milky white discoloration

was observed in the drainage ditch. Malathion was suspected to be the source of the contaminant, as malathion was a product manufactured at the Warners Plant and was known to be deposited in the landfill. Malathion also takes on a milky white discoloration when it comes in contact with water. During a Pre-Sampling Assessment conducted by the NJDEP, Division of Hazardous Waste Management (DHWM), Bureau of Planning and Assessment (BPA) on April 9, 1991, no surface drainage was observed and no stressed or dead vegetation was noted in areas surrounding landfill.

#### GROUNDWATER ROUTE

Geologically, the landfill is underlain by Pleistocene and recent age unconsolidated materials which overlie the Triassic age Brunswick Formation. The unconsolidated materials at the site generally consist of three stratigraphic units: an upper silty sand, an organic-rich meadow mat and a glacial till layer. The soil materials of the upper silty sand layer are generally a very fine to fine sand with variable percentages of silts and clays. The total thickness of the silty sand unit ranges from 4 to 8 feet. Directly underlying the upper silty sand unit is a meadow mat layer, a predominantly organic layer which ranges in thickness from 4 to 7 feet. The meadow mat is densely fibrous, highly porous, vegetative material with a variable percentage of fine sands, silts, clays and fine gravels (shale fragments) found within its structure. The glacial till layer is encountered directly under the meadow mat layer and ranges in thickness from 13 to 16 feet. The till layer is composed of a poorly sorted, a mixture of clay, silt, sand and fine gravels.

The bedrock underlying the area is the Triassic age Brunswick Formation. This formation consists primarily of brown, reddish-brown and gray shale, sandy shale and sandstone. The thickness of the formation is not known but it is believed to be greater than 6,000 feet. The Brunswick Formation is highly fractured and is considered a highly productive aquifer with the most productive water bearing zone lying between 200 and 400 feet below grade.

Groundwater beneath the site exists in the voids of the unconsolidated Quaternary glacial sediments and in the joints and fractures of the Brunswick Formation. Groundwater beneath the site flows into Piles Creek in a southeast and north direction. The depth to the water table ranges approximately 2 to 8 feet below the land surface. Groundwater use in the vicinity of the site is limited to a few industrial wells screened at depths of 26 to 106 feet.

The Linden landfill maintains eight monitoring wells on site. These wells have a depth range of 5 to 26 feet and tap the unconsolidated Quaternary glacial sediments. All wells are located either upgradient or downgradient of the landfill, none are located within the landfill. The wells have been sampled throughout the years since 1986 by the NJDEP, Division of Water Resources (DWR) and Environmental Resources Management of West Chester, Pennsylvania. Results have indicated volatile organic, heavy metal and pesticide contamination. Contaminants included malathion (1 to 30 parts per billion [ppb]), mercury (1 to 6 ppm), arsenic (11 to 3,050 ppb), phenol (1 to 4,900 ppb), benzene (3 to 66 ppb), ethylbenzene (1 to 167 ppb), 2-4-dimethylphenol (1 to 48,000 ppb) and acrolein (1 to 16,833 ppb).

On June 10, 1985 American Cyanamid was issued a NJPDES permit No. 0056227 for groundwater discharge. Actual discharge is leachate from the landfill. The permit required American Cyanamid to test all monitoring wells on site on a periodic basis. However, on April 19, 1989 American Cyanamid's NJPDES permit was determined to be invalid under the Vi-Concrete decision since the landfill closed prior to January 1, 1982. At present American Cyanamid no longer monitors any monitoring wells located at the Linden landfill site.

Groundwater within 4 miles of the landfill is used for public and industrial water supplies. Only one municipality maintains wells tapping the Brunswick Formation within 4 miles of the site. The City of Rahway maintains one well approximately 3.5 miles west of the site, which services approximately 38,000 residents. Contamination of the well is unlikely since groundwater flow is into Piles Creek and the well is located approximately 3.5 miles upgradient from the site.

There are no private water supply wells within 4 miles of the site. However, there are numerous industrial water supply wells with 4 miles of the site, which tap the Brunswick Formation.

#### SURFACE WATER ROUTE

The Linden landfill is located adjacent to Piles Creek a tributary of the Arthur Kill. Piles Creek empties into the Arthur Kill approximately 0.1 stream mile east of the site. The Arthur Kill then flows into Raritan Bay approximately 10 stream miles south of the site or into Newark Bay 2.5 stream miles north of the site depending on tidal influence. Piles Creek is classified as FW-2 nontrout waters. There are no drinking water or industrial surface water intakes within 15 miles of the site and surface water is not used for irrigation purposes.

The potential for surface water contamination exists through groundwater movement and leachate from the landfill. Stream samples collected by Environmental Resources Management in 1986 and 1987 revealed contamination above background.

Linden landfill is located on a estuarine intertidial emergent wetland. The peregrine falcon a state and federal endangered species could have a nesting area within 1 mile of the site.

#### AIR ROUTE

American Cyanamid held no air pollution certificates for the Linden landfill and were not monitored through the NJDEP, Division of Environmental Quality in the past. Currently, a potential for air contamination does not exist since the landfill is inactive and covered with a clay cap. There are no vents located within the landfill.

#### SOIL

No soil samples have been collected at the landfill. However, a potential for soil contamination exists as documentation indicates bulky dry hazardous and liquid chemical wastes were buried at the landfill. During a Pre-Sampling Assessment conducted by the NJDEP, DHWM, BPA on April 9, 1991, soil gas readings were collected along the perimeter of the landfill using an Organic Vapor Analyzer (OVA) and a Hnu photoionization detector. No readings above background were noted.

#### DIRECT CONTACT

There have been no reported incidents of direct contact with hazardous waste or materials on site. However, direct contact is possible since there is a contamination potential of nearby streams which are used for recreation, due to storm and groundwater movement.

#### FIRE AND EXPLOSION

There have been no reported fires or explosions at the Linden landfill. However, a potential exists as hazardous liquid and dry chemicals were known to be buried at the landfill and the landfill is not vented.

#### ADDITIONAL CONSIDERATIONS

Damage to flora and fauna has been observed in areas surrounding the eastern and western border of the landfill where spills or seepage from the landfill has killed meadow vegetation and caused an ink-like bluish hue in the marsh. Contamination of the food chain may occur as some of the contaminants detected on site are bioaccumulative.

#### ENFORCEMENT ACTIONS

On July 1, 1987 the NJDEP, Division of Solid Waste Management (DSWM) issued an Administrative Consent Order (ACO) requiring American Cyanamid to comply with all provisions of the June 10, 1985 NJPDES permit which were not modified by the NJDEP and to complete and submit a hydrogeological study of the area surrounding the Linden landfill. This ACO was voided on April 19, 1989 when American Cyanamid's NJPDES permit became invalid.

AMERICAN CYANAMID LANDFILL - CARTERET  
DRIFTWAY STREET, CARTERET BORO  
MIDDLESEX COUNTY, NEW JERSEY  
EPA ID #: NJD986603439

GENERAL INFORMATION AND SITE HISTORY

The American Cyanamid Landfill is a 110 acre site which occupies Block 9.03, Lot 21; Block 10, Lots 8, 9, 10, 12 through 21; and Block 11.01, Lots 8, 10, 11, 12, 13, 14 and 28 in Carteret, Middlesex County, New Jersey. The landfill is located along the Rahway River approximately 2,000 feet before its confluence with the Arthur Kill River. The New Jersey Turnpike is approximately 0.75 mile to the west and the area is generally industrialized.

American Cyanamid has owned the property since 1939 and operated the landfill from that time until it closed in 1973. The area was a wetland prior to 1939.

SITE OPERATIONS OF CONCERN

The American Cyanamid Landfill accepted wastes from two chemical manufacturing processes at the adjacent Warner Plant in Linden, New Jersey. The sludge wastes were piped via aboveground lines from the Warner Plant, across the Rahway River and into a series of six impoundments where it was slowly dewatered. The impoundments were constructed with both earthen and wooden dikes and eventually covered approximately 100 acres. They are estimated to contain just under two million tons of sludge. The sludge wastes were generated from the production of alum (aluminum sulfate) and yellow prussiate of soda (YPS). Alum is a chemical used in water treatment and styptic pencils and YPS is a complex ferro-cyanide salt used as an additive to table salt and road salt, among other uses.

The production of alum involved the digestion of bauxite ore with sulfuric acid. The resulting muds, primarily silica, were slurried with water, neutralized and pumped to the Carteret facility. The production of YPS (a commercial dye intermediate) involved the reaction of calcium cyanide with ferrous sulfate and soda ash to form sodium ferrocyanide. The resultant muds, primarily calcium carbonate, were slurried with water, neutralized and also pumped to the Carteret facility. The disposal of YPS sludge ceased in 1970 and the disposal of alum sludge ceased in 1973. There has been no sludge disposal of the facility since 1973.

Following the closure of the landfill in 1973, American Cyanamid undertook a study of methods for vegetating and stabilizing the sludge. The vegetation would also minimize wind erosion of the dried surface sediment which, in the past, has blown across roadways. Because the sludge was deficient of several essential nutrients (phosphorus and organic content), composted sewage sludge from Camden and Philadelphia was utilized as a base for vegetative growth. American Cyanamid began vegetating in 1986 and completed the work on impounds 4 and 5 in 1987. Roads were also installed throughout the landfill in 1987 with the road base being constructed from the remains of two buildings which were demolished at the Linden plant. Inert materials such as concrete and terra cotta pipe were used as the road base. By 1989 all of the impounds were vegetated.

In 1981 American Cyanamid collected water and sludge samples from the

impoundments and had the samples analyzed for cyanides and metals. Complex cyanides were detected at levels up to 3,500 ppm in the sludge.

On May 19, 1986, Martin Marietta Environmental Systems analyzed eight aqueous and five sludge samples collected by Hydrosystems, Inc. Total cyanides in the aqueous samples reached 124 ppm and 3,660 ppm in the sludge samples.

American Cyanamid obtained three Vegetation Permits (#87-666, #88-376 and #89-32) from the Freehold Soil Conservation District.

#### GROUNDWATER ROUTE

The American Cyanamid Sanitary Landfill is located on the boundary between the Piedmont and Coastal Plain Physiographic Provinces. Surficial deposits consist of about 20 to 40 feet of Quaternary alluvium composed of interbedded silt, sand, gravel and clay with buried peat and organic rich horizons.

Bedrock underlying the alluvium is the Triassic-Age Brunswick Formation consisting of a dense, hard, red siltstone.

There is a shallow groundwater zone consisting of fill material, meadow mat and black organic rich sandy silt approximately 2 feet below the ground surface. The Brunswick Formation contains the deep groundwater in the area and transmits groundwater through fractures in the siltstone.

Shallow groundwater is mounded beneath the impoundments and flows radially outward from the central area of the impoundments. The shallow groundwater originating within the impoundments discharges into the surrounding surface water. The deeper groundwater is confined and hydraulically separated from the shallow zone by the intervening red-brown clay layer. Groundwater flow in the deeper aquifer is north or northeast where it also discharges into the Rahway River.

Five pairs of monitoring wells were installed at the site in 1987 to provide monitoring data on the shallow and deep groundwater zones. Five wells were screened from depths of 13 to 23 feet in the shallow, black, organic rich, meadow mat and are designated as the "S" wells. Four deep wells were screened in the upper part of the Brunswick Formation and one deep well was screened just above the Brunswick Formation in a gravel layer. These wells are designated as "D" wells.

#### SHALLOW WELL #

	<u>1S</u>	<u>2S</u>	<u>3S</u>	<u>4S</u>	<u>5S</u>
TOTAL DEPTH OF WELL (ft.) FROM TOP OF CASING	23	23	33	28	23
DEPTH TO SCREEN (ft.)	13	13	23	18	13
LENGTH OF SCREEN (ft.)	10	10	10	10	10

	DEEP WELL #				
	1D	2D	3D	4D	5D
TOTAL DEPTH OF WELL (ft.) FROM TOP OF CASING	55	55	63	63	50
DEPTH TO SCREEN (ft.)	45	45	53	53	40
LENGTH OF SCREEN (ft.)	10	10	10	10	10

The ten monitoring wells were sampled by Environmental Testing and Certification Corporation (Lab I.D. #12257) of Edison, New Jersey quarterly from July 31, 1987 to October 16, 1990. The parameters included metals, cyanide, phenols and volatile organic compounds (VOCs). There have been many exceedances of permit limitations within the fifteen quarterly sampling episodes (Attachment N). Metals such as arsenic, cadmium, iron and manganese have been detected as well as high levels of total cyanide (up to 279 ppm in MW-1S). VOCs which exceeded permit limits include benzene (up to 375 ppb in MW-1S), 1,1-dichloroethane (up to 127 ppb in MW-1S), methylene chloride (up to 150 ppb in MW-1S) and toluene (up to 6,490 ppb in MW-1S and 2,940 ppb in MW-1D).

There are no public supply wells within a four mile radius of the site; however there are several industrial wells. There are no known private wells in the area.

There is observed groundwater contamination. The impoundments are not lined and have accepted production wastes for 44 years. Contaminants in the shallow and deep aquifers would be released into the Arthur Kill River and contaminants in the deep aquifer may also affect public water supplies.

American Cyanamid maintains a NJPDES discharge to groundwater (DGW) Permit (#0061611) which was issued on August 18, 1986 and expired on September 29, 1989. A renewal permit application was submitted on March 30, 1989.

Subsequent to the issuance of the permit, American Cyanamid challenged a number of permit provisions entered into negotiations with the NJDEP. The negotiations resulted in the signing of an Administrative Consent Order (ACO) on December 8, 1987.

#### SURFACE WATER ROUTE

American Cyanamid's Carteret Landfill occupies over a mile of shoreline along the Rahway River which discharges into the Arthur Kill River approximately 2,000 feet to the southeast. Oyster Creek and Deep Creek flow through the eastern portion of the site and Cross Creek is located on the western boundary. All three creeks discharge into the Rahway River.

On October 9, 1986, Hydrosystems, Inc. collected three upstream and four downstream samples at high tide and six upstream and four downstream samples at low tide. The aqueous samples were collected upstream and downstream of the impoundments in the Rahway River and were analyzed for total and free cyanides. All samples except for one collected from Cross Creek upstream of the landfill (0.032 ppm) exhibited concentrations below the detection limit.



Although there has been no quantitative evidence of release from the impoundments, there is potential for surface water contamination via the shallow water table discharging directly into the Rahway River.

There have been no reported violations and American Cyanamid holds no permits to discharge to surface water.

#### AIR ROUTE

Prior to the landfill being vegetated, dust from the dried sludge blew freely throughout the area.

#### SOIL

Other than the sludge sampling previously addressed, there has been no soil sampling conducted. The site is underlain with organic-rich meadow mat and has a high water table.

The impounds at the landfill occupy approximately 90 percent of the total site area. There is a potential for soil contamination because the impoundments are unlined and have accepted waste sludge from 1939 to 1973.

#### DIRECT CONTACT

There have been no reported incidents of direct contact at the site. The entire perimeter of the landfill is fenced and has several locked gates barring entrance.

#### FIRE AND EXPLOSION

There have been no reported incidents of fire or explosion and no potential due to type of operations and materials deposited in the impoundments.

#### ADDITIONAL CONSIDERATIONS

During a 1981 study on erosion control, Dames and Moore, consultants for American Cyanamid's revegetation project, observed a number of sick and dead seagulls at the Carteret Landfill. The seagulls regularly use the landfill for loafing, bathing and consuming food scavenged from the adjacent Carteret municipal landfill. American Cyanamid hired an authority from Rutgers University to determine the cause of the mortalities and it was suggested that a botulism outbreak may have occurred. It is not known if any follow-up studies were conducted.

There has been no documented damage to flora or off-site property.

#### ENFORCEMENT ACTIONS

Other than the December 8, 1987 ACO, there has been no other enforcement actions regarding the American Cyanamid Landfill.



To: Distribution

Date: July 9, 1991

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Extension: 289

Subject: PRELIMINARY ASSESSEMENTS  
CARTERET AND LINDEN LANDFILLS

Reference:

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JUL 10 1991

G. R. CAMPBELL

Enclosed are copies of the Preliminary Assessments conducted by the NJDEP for the Carteret and Linden landfills. If you have any comments concerning these reports, please forward them to me by Thursday, July 11th.



A. J. Dohl

AJD:g

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